

81. (New) A power converter as claimed in claim 1 wherein the minimum current limit is effected without disabling the controlled rectifier transistor.
82. (New) A method of converting DC to DC power comprising:
providing a controlled rectifier transistor through which output current flows;
controlling an output voltage through a control circuit; and
overriding control to the control circuit to effect a negative minimum current limit of the output current flowing through the controlled rectifier transistor.
83. (New) A DC to DC power converter having an output comprising:
a controlled rectifier transistor through which output current flows;
a control circuit which controls an output voltage; and
override control to the control circuit, responsive to a condition of the power converter or connected circuitry, to effect a negative minimum current limit of the output current flowing through the controlled rectifier transistor.
84. (New) A DC to DC power converter comprising:
a controlled rectifier transistor through which output current flows;
means for controlling an output voltage through a control circuit; and
means for overriding control to the control circuit to effect a minimum current limit of the output current.

REMARKS

An Information Disclosure Statement (IDS) is being filed concurrently herewith. Entry of the IDS is respectfully requested.

It is noted that there is no explicit rejection of either claim 8 or claim 77. Claim 77 parallels claim 12, both reciting that the minimum current limit is a negative current. There is no suggestion of a negative threshold in Wilcox et al. Accordingly, new claim 82, which corresponds to original claim 77, and new claim 83, which corresponds to original claim 12 without the limitations of intermediate claims 2 and 3, should be allowable along with claims 12 and 77.

Claims 1-7 and 56-59 were rejected under 35 U.S.C. 102 (b) as being anticipated by Wilcox et al. (USP 5,731,694) and claims 9-13 were rejected under 35 U.S.C. 103 as being unpatentable over Wilcox et al. in view of Goder (USP 6,127,814). Those rejections are respectfully traversed.

The present invention was designed to control the amount of back drive current through a controlled rectifier transistor during operation of the transistor. To that end, as the current through a controlled rectifier approaches a minimum, which may be a negative minimum as illustrated in Fig. 22, an override control to the converter control circuit limits further reduction of the current. The current may be limited by increasing the output voltage using a constant current source characteristic 2205, a fold-forward characteristic 2204 or a fold-back characteristic 2206. As discussed at the top of page 27 of the specification, it is significant that the controlled rectifier be left on; that is, the controlled rectifier is not disabled.

Wilcox et al. relates to a switching regulator circuit which shifts into a sleep mode when the current output is sufficiently low that the output capacitor 34 is able to provide that output current for a period of time. In the sleep mode, the controlled rectifiers 16, 17 (Fig. 2) and 116 (Fig. 3) are disabled.

Whether in the operating mode in which the controlled rectifiers switch on and off, or in the sleep mode where the controlled rectifiers are switched off, Wilcox et al. does not attempt to control the output current, that is, the current through terminal 12. Rather, the output current is completely dependent on the current drawn by a load. During the operating mode, a current source 72 in Figures 2 and 3 establishes a minimum value of current I_L through the inductor 32, but that minimum value of current does not effect a minimum output current. Rather, if the output current drops below the minimum value of the inductor current, the inductor current charges the capacitor C_{out} to a level which causes the circuit to change to the sleep mode.

During the sleep mode, with the controlled rectifiers disabled, the current I_L goes to zero, but the output current drawn by the load remains unaffected. There is no minimum to the output current.

The system remains in sleep mode until the output current draws the output voltage below a hysteresis limit. So long as the output current drawn by the load is below the minimum

inductor current I_L , the switching regulator circuit will cycle into and out of the sleep mode to enhance the efficiency at light loads.

Thus, the circuitry of Wilcox et al. does not "effect a minimum current limit of the output current at the output terminals." Depending on the load, the output current could drop, for example, to zero or even go negative even though the minimum value of the inductor current during the operating mode is above zero.

Nor does Goder teach a minimum current limit. Thus, Goder adds nothing toward the claimed invention.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned at (978) 341-0036.

Respectfully submitted,

HAMILTON, BROOK, SMITH & REYNOLDS, P.C.

By 

James M. Smith

Registration No. 28,043

Telephone: (978) 341-0036

Facsimile: (978) 341-0136

Concord, MA 01742-9133

Dated: 

MARKED UP VERSION OF AMENDMENTSClaim Amendments Under 37 C.F.R. § 1.121(c)(1)(ii)

1. (Twice Amended) A DC to DC power converter [having] which delivers an output voltage and an output current at its output terminals, the converter comprising:
 - a controlled rectifier transistor through which [the output] current flows to the output terminals;
 - a control circuit which controls the output voltage; and
 - override control to the control circuit, responsive to a condition of the power converter or connected circuitry, to effect a minimum current limit of the output current [flowing through the controlled rectifier transistor] at the output terminals.
2. (Amended) A power converter as claimed in claim 1 [further comprising a controlled rectifier,] wherein the override control substantially [eliminating] eliminates negative current flow through the controlled rectifier.
12. (Amended) A power converter as claimed in claim [3] 1 wherein the minimum current limit is a negative current.
56. (Twice Amended) A method of converting DC to DC power comprising:
 - providing a controlled rectifier transistor through which [output] current flows to the output terminals;
 - controlling an output voltage through a control circuit; and
 - overriding control to the control circuit to effect a minimum current limit of [the] output current [flowing through the controlled rectifier transistor] at the output terminals.